A REVIEW PAPER ON ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING (OFDM)

Brijesh Kumar[1], Sumit Jindal[2], Prakash Dua[3]

[1] *Assistant Professor, Department of Electronics & Communication, Vivekananda Institute of Technology-East, Jaipur, India*

2012pec5094@mnit.ac.in[1]

[2] *B.Tech Scholars, Department of Electronics & Communication, Vivekananda Institute of Technology-East,Jaipur, India*

sumitjindal44@gmail.com[2]

[3] *B.Tech Scholars, Department of Electronics & Communication, Vivekananda Institute of Technology-East, Jaipur, India*

prakashdua@gmail.com[3]

***ABSTRACT*—**This paper discusses the structure and implementation of an OFDM modem employed in wireless communication. Orthogonal rate of recurrence Division Multiplexing (OFDM) is just about the latest modulation techniques used so that you can combat the frequency-selectivity from the transmission channels, achieving substantial data rate without inter-symbol disturbance. This technique is employed for bandwidth hogging applications including Video Conferencing, DAB, DVB, and many others. Multi-user capacity possible making use of MC-CDMA. OFDM is several techniques proposed to be employed in 4th Generation cellular Systems For the majority of all part, Orthogonal. The bit error rate along with the ISI in multipath surroundings in conventional techniques for instance QAM are very high which often can be reduced by putting into action the OFDM technique. Nonetheless, the occurrence of the actual potentially high peak-to-average electrical power ratio (PAPR) restricts the application.

Keywords*—Orthogonality, Inter Symbol Interference (ISI), Inter Carrier Interference (ICI), OFDM significance*

1. INTRODUCTION

OFDM is usually a new and attractive modulation program with strongly efficient throughout bandwidth usage, immune tobe able to multipath fading environment, a smaller amount ICI and ISI, superior spectral and power proficiency. Because a problem obtained in high-speed communication is inter-symbol disturbance (ISI). It is occurs whenever a transmission interferes with itself and also the receiver cannot decode the particular transmission correctly. [1, 2]

Throughout communication terminology, this is known as multipath. OFDM has higher capacity transmission and adjustable carrier modulation technique, that was chosen for digital sound recording broadcasting (DAB), terrestrial electronic digital video broadcasting – TELEVISION SET (DVB-T), asymmetric digital Prospective Subscriber Lines (ADSL), ultra-wideband technique.

OFDM has also been standardized for the reason that physical layer for the particular wireless networking standard “HIPERLAN2” in Europe so when the IEEE 802.11a, gary the gadget guy standard in the networking typical “HIPERLAN2” in Europe and as the IEEE 802.11a, gary standard in the US, promising raw data rate of between 6 and 54Mbps.

OFDM is researched by mean of Chang PATANG in 1966. ISI will becomes a limitation in high-data-rate transmission. This longer duration causes fewer problems with ISI. Another reason to think about OFDM is low-complexity execution for high-speed systems when compared with traditional single carrier strategies. [3]

2. SIGNIFICANCE

OFDM technique will have an impact an effect on the future connected with communication. Recently, the expansion of digital communication process, the need for high-speed information transmission has increased. It truly is only recently that this advances in integrated world technology have made the particular implementation of OFDM turn out to be feasible and economical. New multicarrier modulation techniques for example OFDM are currently being implemented maintain with the demand with regard to more communication capacity. A few examples of current applications applying OFDM include GSTN (General Switched Telephone Network), Cellular stereo, DSL & ADSL modems. Table **Error! Reference source not found.** lists the primary parameters of the OFDM regular. A key parameter which largely affected the selection of the other guidelines is the guard interval connected with 800 ns, which provides robustness for you to root-mean-squared delay spreads nearly several hundreds of nanoseconds.[3][4]

Table 1: Main Parameters of the OFDM standard

Modulation	BPSK, QPSK, 16-QAM, 64-QAM
Data rate	6, 9, 12, 18, 24, 36, 48, 54 Mbit/s
Number of subcarriers	52
Coding rate	1/2, 2/3, ¾
OFDM symbol duration	4 µs
Number of pilots	4
Subcarrier spacing	312.5 kHz
Protect interval	800 ns
Channel spacing	20 MHz
-3 dB Bandwidth	16.56 MHz

3. ORTHOGONALITY

Orthogonal Frequency Division Multiplexing (OFDM) is really a multicarrier transmission technique, which usually divides the bandwidth straight into many carriers; each one is modulated by a decreased rate data stream. Inside term of multiple entry technique, OFDM is a lot like FDMA (frequency division multiple access) for the reason that the multiple user gain access to is achieved by subdividing the particular available bandwidth into multiple channels which can be then allocated to end users [9].Signals are orthogonal as long as they are mutually independent of each and every other. Orthogonality is property allowing multiple information signals to become transmitted perfectly over a typical channel and detected, without having interference. Loss of Orthogonality end in blurring between these data signals and degradation with communications. Many common multiplexing system are inherently orthogonal. [5][6]

Time Division Multiplexing (TDM) will allow transmission of multiple information signals on the single channel by working out unique time slots for you to each separate information indicate. During each time slot machine game only the signal from your single source is transmitted preventing any interference relating to the multiple information sources. Due to this of this TDM is orthogonal with nature. In the frequency sector most FDM systems are orthogonal as each one of the separate transmission signals are generally well spaced out inside Frequency preventing interference. If any two

different functions in the set are multiplied, and integrated over a symbol period, the result is zero, for orthogonal functions.
Equation (1) shows a set of orthogonal sinusoids, represent the subcarrier for un modulated OFDM signal. [7][8]

$S_k(t)=\text{Sin}(2\pi k f_0 t)$ $0<t<T$ where $k=1,2,3\ldots.$
$= 0$ otherwise (1)

Where f_0 = carrier spacing,
M = number of carrier
T = symbol of period

Since the highest rate of recurrence component is Mf_0 the transmission bandwidth can also Mf_0,sothat the frequency component are orthogonal to one other.

4. SIMULATION FLOWCHART

Figure.1 shows a simplified flowchart of the MATLAB simulation code

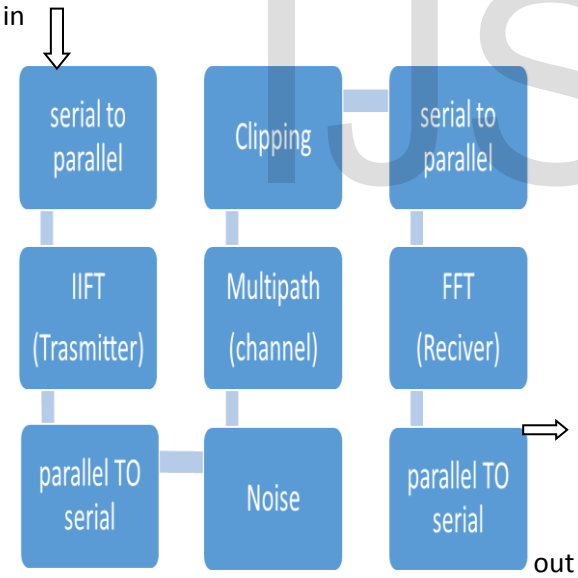

Fig.1 The basic block diagram of OFDM

5. SIMULATION RESULTS

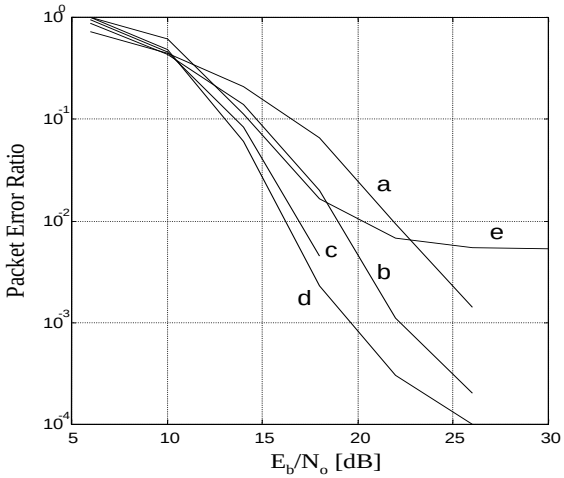

Figure 2: Packet error ratio versus mean E_b/N_o for Rayleigh Fading paths with an exponentially decaying power-delay profile. RMS delay spread is e) 250, d) 150, c) 100, b) 50, a) 25.

As show in figure 2: Five curves are shown for different delay spread values, all at a bit rate of 24 Mbps. It can be seen that as the delay spread increases, the performance improves as the system benefits from the increased frequency diversity in the channel. However, at a certain point the delay spread becomes so large that a significant amount of the multipath signals exceed the guard time of the OFDM symbols. The resulting inter-symbol interference creates an irreducible error floor which is clearly visible in curve e in figure 2. The irreducible error floor does not only depend on the delay spread, but also on the coding rate and QAM type.

6. OFDM APPLICATIONS

OFDM technique is one probably the most prominent technique
Of this kind of communication system .Some associated its applications is provided below.

- DAB: DAB - OFDM forms the foundation for the Digital Audio Broadcasting (DAB) standard in the European market and is the next phase in evolution beyond FM radio broadcasting

providing interference free of change transmission.

- HDTV
- Wireless LAN Networks
- 5.3.1 HIPERLAN/2
- IEEE 802.11g
- IEEE 802.16 Broadband Wireless Access System.
- Wireless ATM transmission system
- IEEE 802.11a

7. LIMITATIONS OF OFDM

There are some hurdles in using OFDM which are as given:

- OFDM signal exhibits high Peak to Average Power Ratio (PAPR).
- Very sensitive to frequency errors (Tx. & Rx. offset)
- Intercarrier Interference (ICI) between the subcarriers

CONCLUSION

This paper proves that OFDM is much better suited to a multipath channel than the usual single carrier transmission method such as16-QAM**.** The desire for high data rate wireless communication have been increasing drastically throughout the last decade. This paper has looked into the role of OFDM within the wireless communication and it is advantages over single provider transmission. There are also a few limitations of this technique which is often removed with the guide of suitable techniques.

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